DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a perspective view for showing one embodiment of the invention. FIGS. 2A–2E are illustrations for showing one example of an electrophoretic chip in which many separation passages are formed and which is mounted to the embodiment of FIG. 1, of which FIG. 2A is a top view for showing one substrate, FIG. 2B is a top view for showing the other substrate, FIG. 2C is a top view for showing a state where both substrates are connected on one another, FIG. 2D is an expanded top view for showing an encircled part of FIG. 2C, and FIG. 2E is a cross–sectional view for showing a separation passage part of FIG. 2C.

Firstly, the electrophoretic chip shown in FIGS. 2A–2E shall be described.

An electrophoretic chip 1 is comprised of one pair of plate–shaped substrates 1a and 1b made of an inorganic material (e.g., glass, quartz, silicon or the like) or plastic. The substrates 1a and 1b measure, for example, 1.1 mm in thickness.

One substrate 1b has 16 pairs, each of which consists of a specimen–introducing passage 11 and a separation passage 13 intersected with each other, formed in its surface by a photolithographic technology used in semiconductor–device manufacturing processes or by a micro–machining technology. The specimen–introducing passage 11 and the separation passage 13 measure approximately, for example, 100 μm in width and 50 μm in depth. Each of these 16 pairs of the passages 11 and 13 are arranged in a sector shape with, as a pivot thereof, one end side of the separation passage 13 opposite the side intersecting with the specimen–introducing passage 11 so that they do not intersect with the other pairs. The substrates 1a and 1b are formed in a sector shape so as to match the arrangement of the separation passage 13.

The other substrate 1a has an anode reservoir 15a, a cathode reservoir 15c, a specimen reservoir 15s, and a waste reservoir 15w formed as through holes therein at positions corresponding to the ends of the passages 11 and 13. The reservoirs 15s and 15w are provided for each pair of passages 11 and 13. The anode reservoir 15a is provided common to each one end side of the separation

passage 13 of each pair on the pivot side in the sector-shape arrangement. The cathode reservoir 15c is formed in an elongated hole common to the other end side of the separation passage 13 of each pair.

As shown in FIG. 2D, the specimen-introducing passage 11 extending from the specimen reservoir 15s and the specimen-introducing passage 11 extending from the waste reservoir 15w are connected to the separation passage 13 with a spacing of, for example, 100 μm therebetween.

The electrophoretic chip 1 is used in a state where both substrates 1a and 1b are connected on one another.

Such an electrophoretic chip is called a multi-channel micro-chip because it has many separation passages formed therein.

The electrophoretic apparatus shall be described as follows with respect to FIG. 1.

A disk-shaped multi-chip turn table (electrophoretic-member holding part) 3 is provided. On the table 3 are held, for example, 10 sheets of the electrophoretic chips 1. These 10 electrophoretic chips 1 are evenly spaced in arrangement on the table 3 in such a manner that the substrate 1a in which are formed the reservoirs 15a, 15c, 15s, and 15w faces upward and also that the pivot of their sector shapes is oriented toward the center. This arrangement of the electrophoretic chips can be realized by, for example, forming in the surface of the table 3 a recess in correspondence with the sector shape of the electrophoretic chips 1 beforehand or by forming alignment holes in the electrophoretic chips 1 so that pins or any other protruding members may be arranged at position corresponding to those holes. The table 3 is provided with a mechanism (not shown) for rotating the table 3 using the center of the table 3 as a rotation axis in a place in which the electrophoretic chip 1 is held.

Near the table 3 is provided a specimen dispensing mechanism fitted with a specimen transfer head 5 and specimen plate 7 for containing many test-specimens at a time. In the figure, a part not constituting the head 5 of the specimen dispensing mechanism is not shown. The head 5 is provided with eight nozzles 5a in correspondence with the positions of the adjacent eight specimen reservoirs 15s of the electrophoretic chip 1. The specimen plate 7 has a well 7a

formed therein for 384 holes (24 × 16) for containing test-specimens, corresponding to a spacing between the nozzles 5a of the head 5.

Though not shown, near the table 3 are arranged a voltage application part provided with electrodes at the respective positions corresponding to the reservoirs 15a, 15c, 15s, and 15w of the electrophoretic chip 1 and a detection part for detecting a specimen in the separation passage 13 of the electrophoretic chip 1.

The operations of this electrophoretic apparatus shall be described with respect to FIGS. 1 and 2A-2E as follows.

Beforehand the passages 11 and 13 are filled with a separation medium to then, arrange on the table 3, 10 sheets of the electrophoretic chips 1 each having the reservoirs 15a, 15c, 15s, and 15w filled with a buffer liquid. Although this example uses the electrophoretic chip 1 filled with a separation medium and a buffer liquid beforehand, the invention is not limited to this example; for example, near the table 3 may be provided a dispensing mechanism for injecting an electrophoretic medium or buffer liquid, so as to fill the electrophoretic chip 1 with the electrophoretic medium after the electrophoretic chips 1 are arranged on the table 3.

Using the table 3, the eight specimen reservoirs 15s into which a specimen is to be dispensed firstly are aligned with a specimen dispensing position 9.

Using the specimen dispensing mechanism, head 5 is driven to suck the test-specimens contained in the eight different wells 7a in the specimen plate 7 into the eight nozzles 5a respectively to then move the head 5 to the dispensing position 9, thus dispensing the test-specimen thus sucked in the nozzles 5a into the eight specimen reservoirs 15a simultaneously.

After the head 5 is lifted by the specimen dispensing mechanism, the table 3 is rotated to position the next eight specimen reservoirs 15s at the specimen dispensing position 9. Then, the above-mentioned specimen dispensing operations are performed to dispense the test-specimen into the eight specimen reservoirs 15s simultaneously.